State & Private Forestry
FOREST HEALTH PROTECTION
Northern California Shared Service Area

Date: May 5, 2023

Subject: Treatment of conifer stumps to prevent Heterobasidion root disease (HRD) in campgrounds within the Trinity Lake Unit of the Whiskeytown-Shasta-Trinity National Recreation Area. (FHP Report No. NC23-002)

Issue*: In the fall of 2022 a site visit was made to Alpine View, Tannery Gulch, and Hayward Flat Campgrounds to investigate Heterobasidion root disease (HRD; aka annosus root disease) in preparation of the Trinity Unit Campground Forest Health Project. This report provides background information on HRD, a summary of site visit findings, current Region 5 policy regarding management of HRD, and management recommendations as requested by Todd Hamilton, District Silviculturist.*

Background

- HRD is one of the most important native conifer diseases in California. The disease causes mortality and loss of vegetation cover, predisposes trees to attack by other fungi and insects, predisposes trees to windthrow, and alters successional trajectories. In recreation areas, this disease is a particular problem since windthrown trees can cause injury, death, or property damage.
- The distribution of HRD in California increased during the mid-1800s due to logging activities that followed the gold rush and westward expansion. Aerially dispersed spores readily germinate on and colonize stumps generated by logging activity and infect adjacent trees via root contacts.
- The disease is currently distributed throughout the range of its hosts but is most prevalent in mixed-conifer and eastside pine forests. Elsewhere, it can be found patchily distributed across forested lands.
- HRD is caused by two species of fungi that attack different sets of hosts. *Heterobasidion irregulare* (formerly referred to as the P-type) primarily infects pine species and incense cedar while *Heterobasidion occidentale* (formerly referred to as the S-type) is primarily found infecting fir. The diseases caused by each species differ in some regards, but the convention is to refer to them together as HRD. A key difference is that *H. irregulare* does not infect living fir and *H. occidentale* does not infect living pines, however, all conifer stumps are susceptible to colonization by either species.
- If applied within 24 hours, treating stumps with a California registered borate compound has been shown to effectively prevent stump colonization by the aerially dispersed spores of *Heterobasidion* species. . Currently, only the liquid formulation (Cellu-Treat) is commercially available, but it is permissible to apply the powdered formulation (Sporax) if supplies remain.
- R5 Forest Service Manual 2300-92-1 (Recreation, Wilderness, and Related Resource Management) states, “To perpetuate the forest environment in and around developed recreation sites, treat all freshly cut coniferous tree stumps to prevent introduction and spread of Fomes annosus.” This document made stump treatment mandatory in developed recreation sites but was removed in 2009 and has not been reissued or replaced.
- R5 Forest Service Handbook Supplement 3409.11-2013-1 (Management of Specific Pests) recommends the treatment of freshly cut stumps 3” and larger in developed recreation areas, or other highly valued sites, with a borate compound to prevent HRD infestation. However, it has come to the attention of R5 Forest Health Protection (FHP) Staff that this supplement was removed June 10th, 2018 (prior to expiration date of June 10th, 2023). This supplement is in the process of being reissued and should be effective before the end of fiscal year 2023.
- There are no National-level directives regarding the management of HRD.

Findings

- The forests in and around Trinity Lake have not been intensively surveyed for HRD. A query of the California Insect and Disease Atlas (CAIDA), a geospatial database that contains historical FHP insect and disease detection, survey, and evaluation reports for the past 50-plus years, in conjunction with the R5 FHP Pest Observations Database, a more recent database that has supplanted CAIDA, provided reports of *Heterobasidion irregulare* at multiple locations within the Whiskeytown-Shasta-Trinity National Recreation Area, including one location within a half mile of Alpine View CG (Figure 1).
- The site visit revealed a patch of pine and juniper mortality (mortality center) indicative of HRD (*H. irregulare* can infect juniper) at Alpine View CG (Figures 2 and 3). The mortality center was associated with multiple pine stumps including one with laminated rot, a symptom associated with HRD (Figure 3).
- At Tannery gulch CG, one downed Douglas-fir was found with rot symptoms indicative of HRD. Douglas-fir is susceptible to *H. occidentale*, but infections typically occur at a low enough incidence that it is not considered a problem from a management perspective in California. This species of *Heterobasidion* does not infect living pine or incense cedar.
- Signs and symptoms of three other root diseases were found at Tannery Gulch CG; a previously known patch of Douglas-fir mortality caused by Armillaria root disease, a patch of ponderosa pine mortality caused by black stain root disease, and fruiting bodies of the velvet-top fungus that causes a root and butt rot of Douglas-fir. These diseases will not be discussed further in this report.

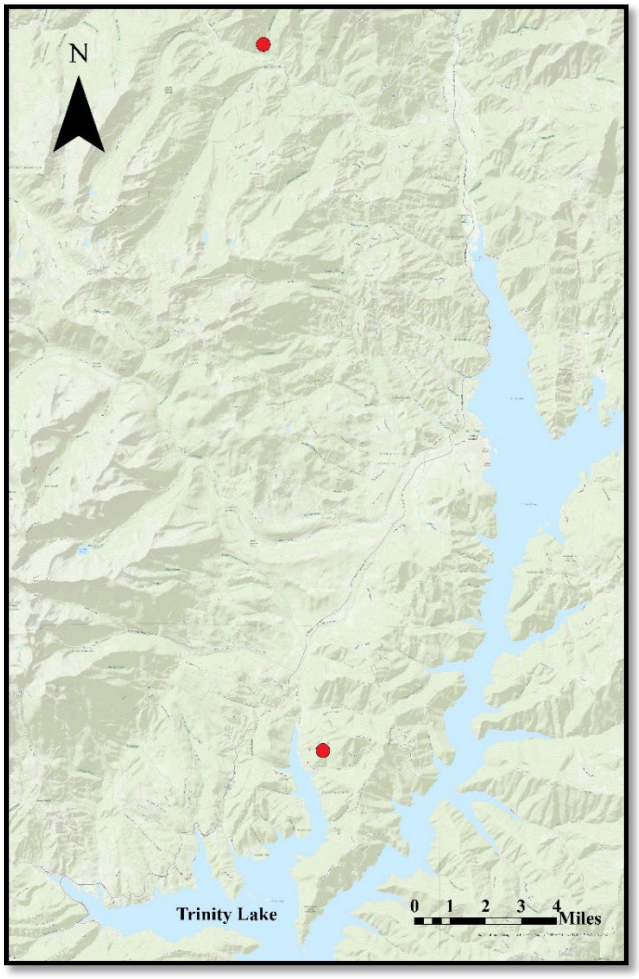

Figure 1. California Insect and Disease Atlas (CAIDA) reports of Heterobasidion root disease (red dots) identified near Trinity Lake, Whiskeytown-Shasta-Trinity National Recreation Area, CA.

Figure 2. Juniper mortality center at Alpine View CG, Trinity Lake, Whiskeytown-Shasta-Trinity National Recreation Area, CA.

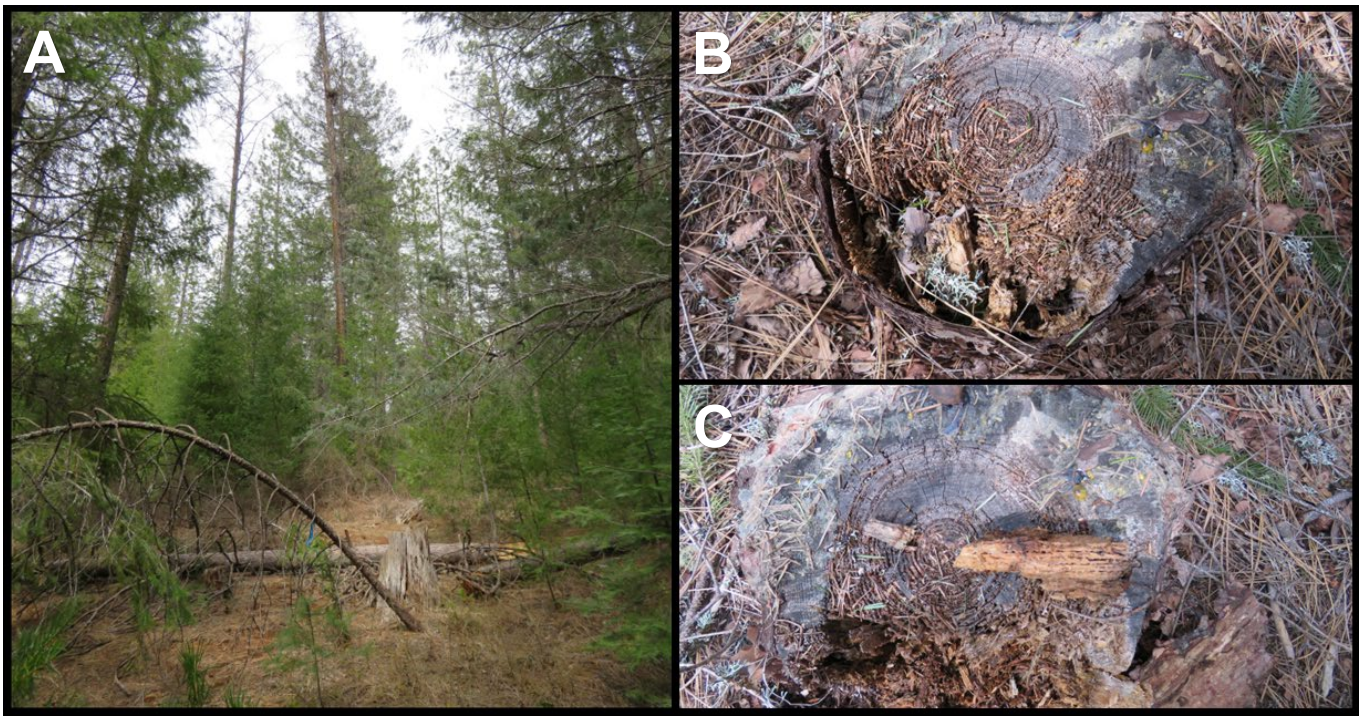

Figure 3. Evidence of Heterobasidion root disease (HRD) at Alpine View CG, Trinity Lake, Whiskeytown-Shasta-Trinity National Recreation Area, CA. Image A) is a mortality center with pine stumps, pine mortality, and Douglas-fir (non-host) regeneration. Images B) and C) are pine stumps with laminated rot, a symptom associated with HRD.

Discussion

- It is important to recognize that the CAIDA and Pest Observations databases do not represent systematic surveys for disease presence or incidence. They merely contain pest detection reports that have been submitted from FHP and CALFIRE over the past 50-plus years. These databases provide an indication of whether the pathogen may reasonably be expected to be present in or near a particular area. Additional areas with unreported HRD may be present, and it is possible (though unlikely) that the fungal pathogen may have died out of some of the areas where it had been previously reported.
- The CAIDA database and site visit observations provide ample evidence to indicate that there is a potential for the establishment of new HRD infestations if freshly cut stumps are not treated with Sporax or Cellu-Treat in the project area.
- The objective of treating stumps in campgrounds and other developed recreation areas is to prevent HRD infestation, disease development and spread, and subsequent tree mortality, and to maintain a safe environment. Once *Heterobasidion* has become established on a site it is difficult or impossible to eradicate.
- Although all conifer stumps can be colonized, only living pine, incense cedar, and juniper in the project area are susceptible to *H. irregulare* (juniper is a minor component of forests in the project area). For disease spread and mortality to occur, the roots of an infected stump or tree must contact a susceptible root system of a living host. The high proportion of Douglas-fir in the project area should reduce the risk of disease spread and subsequent tree mortality.
- Although the R5 FSH Supplement 3409.11-2013-1 recommends treating stumps 3" and greater in developed recreation areas, there is no evidence that infection of 3" stumps results in disease spread or tree mortality. The original motivation for the 3" recommendation was to effectively eliminate the risk of disease spread and subsequent tree mortality occurring in high use areas. However, an unnecessarily small stump diameter limit may impose an unnecessary use of fungicide and an excessive operational burden on a project.
- Historic Region 5 stump diameter limits for treatment were largely based on observations and studies in eastside pine forests. The initial recommendation was to treat stumps 6" and greater, based on studies indicating internal temperatures reached lethal levels in smaller stumps. Later, the recommendation was raised to 8" when it was observed that disease spread did not occur following pre-commercial thinning. A survey on the McCloud Ranger District found that infection of stumps smaller than 14" in diameter did not support infection centers. Results from a survey on the Modoc National Forest suggest stumps smaller than 18" do not support the development of conks, a prerequisite for spore-based stump infection. Additional studies in Sierra Nevada pine stands indicate stumps smaller than 18" do not support the development of conks (Kleijunas 1989, Kelijunas and Woodruff 2004).

Recommendations

- Based on available information, treating stumps 6" in diameter and greater (outside bark) should effectively eliminate the risk of new infestations and disease spread under most conditions, however, a 3" diameter limit may still be desirable in some cases. In the case of the Trinity Unit Campground Forest Health Project, with the abundance of non-host species interspersed among host species, treating all freshly cut coniferous stumps 6" in diameter and greater in developed recreation sites should eliminate the risk of new infestations occurring in those areas.
- Alternatively, the line officer may decide to treat stumps 8" in diameter (outside bark) and greater in developed recreation sites which should reduce the risk of new infestations, although, it should be noted that this risk increases with stump diameter.
- All freshly cut coniferous stumps 14" and greater should be treated outside of developed recreation sites.
- All stump treatments should be applied using a California registered borate compound as soon as possible after felling trees, but no longer than 24 hours. The sooner stumps are treated after felling, the greater the efficacy.

References

- Kliejunas, J.T. 1989. Borax stump treatment for control of annosus root disease in the eastside pine type forests of northeastern California. p. 159-166. In: Otrosina, W.J. and Scharpf, R.F., tech. coordinators, Proceedings of the symposium on research and management of annosus root disease (*Heterobasidion annosum*) in western North America: April 18-21, 1989; Monterey, CA. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Gen. Tech. Rep. PSW-116. Berkeley, CA.
- Kleijunas, J.T.; Woodruff, W. 2004. Pine stump diameter and Sporax treatment in eastside pine type stands. USDA Forest Service, Pacific Southwest Region, Report Number R04-01. 7 p.

Contacts: *Ashley Hawkins, Northern California Plant Pathologist (530) 226-2436 ashley.hawkins@usda.gov; Cynthia Snyder, Northern California Entomologist (530) 226-2437 cynthia.snyder@usda.gov if you have questions or need assistance from FHP.*